OUTLINE

- Problem Addressed: Spring vs. Fall Chinook
- Problem Approach: Optimality Model
- Results
- Conclusions
PROBLEM ADDRESSED

Spring vs. Fall Chinook

- Spring Chinook: March, May
- Fall Chinook: July, September
ADAPTATIONIST’S VIEWPOINT

- Run timing is shaped by selective pressures described by a trade-off between ocean growth and passage opportunity.

Benefit

Late Run  →  Ocean Growth

Early Run  →  Passage
            Opportunity
MODELLED APPROACH

Optimization Model

- State Variables - Weight and River Kilometer
- Control Parameter - Run Timing
- Stochastic Input - Passage Events (Random)
- Surrogate Fitness Measure - Expected Fecundity
FLOW DIAGRAM

Current Velocity, $u$

Obstruction

Run Timing, $t_0$

River Kilometer, $x$

Swimming Velocity, $v$
GOAL 1

Construct a curve that gives the expected fecundity as a function of run timing.

- What is the optimal run timing?
ALGORITHM

1. Select a run time $t_0$.

2. Draw 500 random passage opportunity histories.

3. For each history, determine the associated fecundity.

4. Calculate the expected fecundity.

5. Increment $t_0$ and go to (1).
EXPECTED FECUNDITY

\[ \lambda = 0.03 \]

Migration Date

Expected Fecundity (egg number)

Jan Feb March April May June July Aug Sept
GOAL 2

Construct a curve that gives the optimal run timing as a function of the passage opportunity rate, $\lambda$.

- Does the optimal run time increase with $\lambda$?
PASSAGE OPPORTUNITIES
OPTIMAL MIGRATION DATE
CONCLUSIONS

• The relationship between run timing and passage opportunity can be examined using optimality modelling.

• All else being equal, spawning populations subject to rare passage opportunities optimally run earlier than populations with abundant passage opportunities.